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ABSTRACT

Attempts to apply Piagetian theory and research to educational settings are reviewed and evaluated. The fundamental assumptions of Piagetian theory are briefly summarized and the educational philosophy of Piaget is explained. Five representative early childhood education programs are described. Current criticisms of Piagetian theory and associated educational recommendations are reviewed and it is concluded that adopting a genuine Piagetian perspective conveys mixed blessings upon the aspirant educational innovator. The following principles are thought to be major, valid principles that may be derived from the Piagetian system: an awareness of intellectual product/process distinctions, a recognition of the crucial role of play activities, social interaction and associated peer group processes, and the essential stipulation of self-initiated active involvement as the primary determinant of intellectual development. The third principle is thought to provide the fundamental continuity between Piaget's views and the numerous open classroom and self-discovery learning approaches to educational innovation. (Author)

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THE SEARCH FOR A DISTINCTLY PIAGETIAN CONTRIBUTION TO EDUCATION

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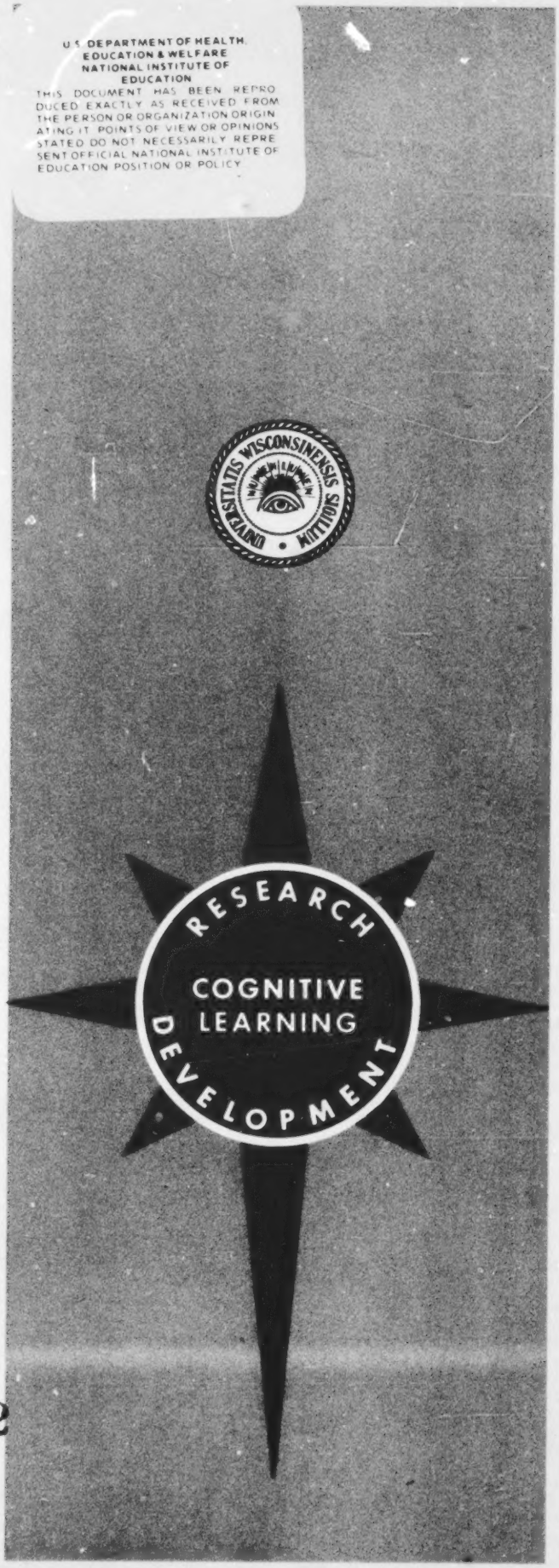

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Theoretical Paper No. 50

THE SEARCH FOR A DISTINCTLY PIAGETIAN CONTRIBUTION TO EDUCATION

by

Frank H. Hooper and John D. DeFrain

Report from the Project on Conditions of School Learning and Instructional Strategies

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Statement of Focus

Individually Guided Education (IGE) is a new comprehensive system of elementary education. The following components of the IGE system are in varying stages of development and implementation: a new organization for instruction and related administrative arrangements; a model of instructional programing for the individual student; and curriculum components in prereading, reading, mathematics, motivation, and environmental education. The development of other curriculum components, of a system for managing instruction by computer, and of instructional strategies is needed to complete the system. Continuing programmatic research is required to provide a sound knowledge base for the components under development and for improved second generation components. Finally, systematic implementation is essential so that the products will function properly in the IGE schools.

The Center plans and carries out the research, development, and implementation components of its IGE program in this sequence: (1) identify the needs and delimit the component problem area; (2) assess the possible constraints—financial resources and availability of staff; (3) formulate general plans and specific procedures for solving the problems; (4) secure and allocate human and material resources to carry out the plans; (5) provide for effective communication among personnel and efficient management of activities and resources; and (6) evaluate the effectiveness of each activity and its contribution to the total program and correct any difficulties through feedback mechanisms and appropriate management techniques.

A self-renewing system of elementary education is projected in each participating elementary school, i.e., one which is less dependent on external sources for direction and is more responsive to the needs of the children attending each particular school. In the IGE schools, Center-developed and other curriculum products compatible with the Center's instructional programing model will lead to higher student achievement and self-direction in learning and in conduct and also to higher morale and job satisfaction among educational personnel. Each developmental product makes its unique contribution to IGE as it is implemented in the schools. The various research components add to the knowledge of Center practitioners, developers, and theorists.

Acknowledgments

Sincere thanks are extended to Anne Bingham-Newman and Ruth Saunders. Many of the more worthwhile ideas presented here resulted from continuing conversations with them. In particular, their notable efforts over a period of three years (1971-1974) resulted in the Piagetian Preschool Education Program (PPEP). In addition, our thanks to Beilin (1971b) whose discussions were relied upon as authoritative sources for training research evaluations and Kamii and DeVries (in press) for their accurate conceptualizations of Piagetian orientations to early education.

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Abstract

Attempts to apply Piagetian theory and research to educational settings are reviewed and evaluated. The fundamental assumptions of Piagetian theory are briefly summarized and the educational philosophy of Piaget is presented. Five representative early childhood education programs (as designed by Lavatelli, Weikart, Kamii and DeVries, Furth and Wachs, and Bingham-Newman and Saunders) are described and related. Current criticisms of Piagetian theory and associated educational recommendations are reviewed and it is concluded that adopting a genuine Piagetian perspective conveys mixed blessings upon the aspirant educational innovator. The major valid principles which may be derived from the Piagetian system include: (1) an awareness of intellectual product/process distinctions, (2) a recognition of the crucial role of play activities, social interaction, and associated peer group processes, and (3) the essential stipulation of self-initiated active involvement as the primary determinant of intellectual development. The third principle provides the fundamental continuity between Piaget's views and the numerous open classroom and self-discovery learning approaches to educational innovation.

I
Introduction

The single explicit purpose of this discussion is to place into proper perspective the various attempts to translate Piagetian theory and research into viable educational settings.

It has been seven years since one of the present writers optimistically stated, "Piaget's system offers an effective liaison between the developmental status of the child and the curriculum designed to convey society's knowledge, values, and problem-solving strategies. . . . Assuming a basic connection between developmental theory and educational application, the research generated by Piaget's ideas should be of great assistance to the teacher and curriculum designer. (However) the major task of implementing these ideas and translating the principles into operational educational procedures remains to be accomplished [Hooper, 1968, p. 423 and 431]." Subsequently, the Piagetian theoretical orientation has gained a popularity in educational circles which probably rivals that accorded to Dewey's views during the 1920's and 1930's (cf. Sullivan, 1967, 1969). General discussions of the putative relevance of the Genevan perspective to education are indeed numerous (e.g., Aebli, 1951; Athey & Rubadeau, 1970; Beard, 1969; Brearly & Hitchfield, 1969; Bruner, 1960; Furth, 1970; Klausmeier & Hooper, 1974; Kohlberg, 1968; Schwebel & Ralph, 1973; Sigel, 1969; Stendler, 1965; and Wallace, 1965). More significantly there have been a number of attempts (which, as we shall see, vary markedly in the degree of adherence to the Piagetian orthodoxy) to actually implement the general Piagetian principles and specific developmental norms in early childhood education classrooms (Bingham-Newman, Saunders, & Hooper, 1974; Furth & Wachs, 1974; Kamii, 1972; Kamii & DeVries, in press; Lavatelli, 1971; Sigel, Forman, & Secrist, 1972; Sigel, Secrist, Sorce, Priebe, & Norris, 1973; and Weikart, Rogers, Adcock, & McClelland, 1971). With all this discussion and field research, it seems appropriate to ask whether, or to what degree, Piagetian theory is applicable to actual classroom situations. In this paper we will review past attempts to apply the theory and will provide a general evaluation. It will be seen that adopting a purely Piagetian perspective conveys mixed blessings to the aspirant educational innovator.

II
Primary Points to Consider

The Piagetian system and associated normative and instructional research (much of which may be characterized as Neo-Piagetian) provides three primary contributions to the professional educator (Flavell, 1963). First, it provides a series of viable alternatives to conventional psychometric measures of intellectual ability and functional status. The various concrete and formal operations task formats dealing with such logical content domains as classification, relationality, number, probability, combinatorial reasoning, etc., and the infralogical concepts concerned with measurement, space, time, and conservation remain available for use as readiness or achievement indices. Unfortunately, the psychometric characteristics (primarily concerning reliability) of the Piagetian tasks remain terra incognita. Much of the current disagreement among Piagetian researchers concerns the sanctity of the méthode clinique with the inherent non-standardization which its straightforward utilization entails. More importantly the validity of the Piagetian measures as predictors or concomitants of conventional school achievement indices remains conjectural. Nonetheless, the Piagetian concept tasks are potentially of significant value.

Secondly, the Piagetian system provides an innovative organizational framework and a wealth of substantive content for curriculum design and evaluation. The directives for curriculum selection and sequencing follow directly from the stage-dependent properties of the development of children's logical reasoning. For example, the dominant characteristics of concrete operational thought (perhaps as represented in the logical groupements, cf. Brainerd, 1972; Flavell, 1963; Piaget, 1972) could form the basis for class and relations instruction.

Thirdly, the Genevan orientation to learning and education provides alternative instructional strategies to those derived from behavioristic learning models. These stem from the stage-independent aspects of Piaget's biological model of cognitive growth and place the teacher who wholeheartedly accepts the Piagetian perspective squarely among the proponents of open classroom teaching and self-discovery learning.

III
Fundamental Assumptions of Piagetian Theory

For the material in this section the reader should be familiar with the basic tenets of Piaget's theory, the characteristics of the four major developmental periods, and the associated research findings. (Excellent overview sources include Flavell, 1963; Ginsburg & Opper, 1969; Langer, 1969; Piaget, 1966; and Piaget & Inhelder, 1969.) Thus only those assumptions which are of direct relevance to educational philosophy and implementation will be emphasized.

It may come as some surprise to the reader that although Piaget makes no claim to expertise in pedagogical domains he has produced a commendable series of articles and essays on educational practice (e.g., Piaget, 1928, 1930a, 1930b, 1930c, 1931, 1932, 1934, 1935, 1951, 1964, 1970a, 1970b). The dialectical constructive nature of cognitive development which Piaget so adamantly espouses places him midway between the conceptual-philosophical polarities of genetic preformationism (or maturationism) and environmentally programmed S-R determinism. In the Piagetian system:

> The ongoing process whereby the individual gains knowledge about external objects, the self, and self/object relationships is considered to be a natural outcome of an active interactionist system. Epistemologically, in a very real sense the individual constructs himself and the world around him. At no point in Piaget's model can man or the external world ever be defined independently of each other; the changing structure of each is mutually derived from this continuing dialectic (Riegel, 1973a, 1973b) [Hooper & Klausmeier, 1973, p. 11].

There are three basic components of intellectual development in Piagetian theory and these are viewed as formally equivalent to their counterparts in general biological growth and functioning. Intially there are the functional invariants of assimilation and accommodation which together determine the presence or absence of adaptation (in Piaget's later writings these are subsumed under the rubric of equilibration dynamics).

> Assimilation (which may be considered as logically and temporally preceding accommodation, although it can only arbitrarily be viewed in isolation) is the incorporative aspect of an operative action, that is, "A taking in of environmental data, not in a causal mechanistic sense, but as a function of an internal structure that by its own nature seeks activity [Furth, 1969, p. 260]." In this manner, incoming stimulation is modified vis-à-vis the individual's current structural makeup. Accommodation, correlatively, is the outgoing aspect of an operative process and denotes the modifications that take place in the individual's cognitive makeup as a consequence of environmental intrusions [Klausmeier & Hooper, 1974, p. 7].

These functional components of assimilation and accommodation are formally constant and ever-present across the life span.

In addition, there are the environmental inputs or aliments (content for Flavell, 1963, p. 17) which are formally nondeterminant or random in nature. Formally "located" between the functional invariants and the environmental inputs is organization or structure which

alters systematically with increasing age up to maturity. These changing structural characteristics form the definitional basis for the major developmental stages.

For Piaget, there are four major determinants of cognitive development: (1) biologically constrained maturation, (2) experiences with objects including the self (in which physical and logico-mathematical experiences may be distinguished), (3) social transmission which includes all forms of linguistic communication, and (4) equilibration which coordinates and integrates the other three factors. As Kamii and DeVries state, "Equilibration, which regulates the influence of the three other factors, refers to an internal regulatory process of differentiation and coordination which always tends toward increasing adaptation. While learning takes place as a result of specific encounters with the external world, development takes place as a result of equilibration [in press, p. 15]." Although Piaget clearly acknowledges that experiential factors are essential to cognitive growth, he seriously questions the ethics and the efficacy of directed teaching insofar as logico-mathematical thought. In this instance learning is subordinate to development.

Closely related to these four determinants of cognitive development are the three forms of knowledge with which Piagetian theory is concerned. The distinctions among the three forms of knowledge present the most straightforward implications for both educational philosophy and practice. While traditional learning theorists recognize only sources of knowledge which are external to the individual organism, Piagetian theory recognizes knowledge types which have both external and internal sources.

First, we have physical knowledge which emanates only from contacts with the environment and depends upon the recurrent regularities which are gradually discovered and mastered. The second form is social knowledge which is, by definition, arbitrary in nature and is transmitted via intermediary means such as parents, teachers, peers, books, mass media, etc. The classroom plays a major role in the transmission of social, or culturally determined, information. Finally, by far the most important knowledge form for the Piagetians is logico-mathematical knowledge.

Logico-mathematical knowledge concerns the fundamental categories of human reasoning dealing with classes, relations, number concepts, deduction, and inference. Certain infralogical concepts concerning space, time, conservation, and measurement are also included. From the Genevan perspective, the outstanding characteristic of logico-mathematical thought is that it is not directly teachable (Kamii & DeVries, in press).

> Logico-mathematical knowledge is an intriguing domain that has several unique characteristics. First of all, it is not directly teachable because it is constructed out of relationships the child himself has created among objects, and every subsequent relationship he creates is a relationship among the relationships he created before. The processes involved in this construction are reflecting abstraction and equilibration.
>
> The second characteristic of logico-mathematical knowledge is that if it is left alone to develop, or if the child is encouraged to be alert and curious about his environment, there is only one way in which it develops, and that is toward more coherence. Because there is nothing arbitrary in logico-mathematical knowledge, if the child constructs it at all, he will construct it toward more and more coherence. All normal children will have class inclusion sooner or later without a single lesson in class inclusion.
>
> A third characteristic of logico-mathematical knowledge is that if it is constructed once, it will never be forgotten. Once the child has class inclusion, he will never look for a cow that is not an animal. Besides, empirical verification is superfluous in logico-mathematical knowledge [Kamii & DeVries, in press, p. 16].

This suggests, of course, that children who are alert and curious (assuming neurophysiological integrity and minimal external stimulation) will inevitably acquire logico-mathematical reasoning. Moreover, significant acceleration of the acquisition of these concept domains is only a remote possibility if indeed it exists at all.

As may be expected these sweeping generalizations have not gone unchallenged. Perhaps the greatest controversy concerning Piagetian research centers upon the trainability of logico-mathematical concepts. The issues are exceedingly complex but most of the Genevans argue against the efficacy of teaching while much of the Neo-Piagetian training literature presents contrary conclusions (cf. Beilin, 1971b; Brainerd, 1974; Glaser &

Resnick, 1972; Klausmeier & Hooper, 1974; and Strauss, 1972). Conservatively speaking, the Piagetian generalizations have yet to be nonambiguously demonstrated in empirical research.

Perhaps a concrete example of the three knowledge forms would help to clarify their interrelationships. A child has to be specifically taught the "names" Europe and North America and the "labels" Eastern and Western hemispheres. Teaching this may be enhanced by certain aids which embody physical experiences, e.g., the use of special projection maps or a globe. These culturally specific bits of information may be distinguished, however, from the classificatory relations explicit in adult reasoning about geographical hierarchies. Thus, understanding of the part/whole relationships in the hierarchy Detroit-Michigan-U.S.A.-Western Hemisphere and the multiple class membership which is implied, only becomes possible during the later concrete operations period years. It is this latter form of understanding which has preoccupied the interests of the Genevan investigators. They care less about the origin of units of class concepts than the coordination (intensive and extensive relations) of the systems of classification.

IV
Educational Philosophy and Applications

Piaget on Education

Piaget's philosophy of education has been developed in a series of articles, books, and lectures dating back forty-six years. As his developmental theories evolved, his views on education followed suit. Our emphasis here will be on his latest statements rather than on a historical approach.

Suppose it were known that the structural variations of a child's thought are determined from within, that they are constrained by an immutable order of succession and an unvarying chronology, that each stage begins at its appointed moment and occupies a precisely ordained period of the child's life. Suppose, in short, that the development of thought is comparable to an embryology obeying strict hereditary rules. The consequences for education would be incalculable.

> The teacher would be wasting his time and his effort attempting to speed up the development of his students, and the problem would simply be that of finding out what knowledge corresponded to each stage and then to present it in a manner assimilable by the mental structure of the age level in question [Piaget, 1970b. pp. 166-167].

Conversely, if it were known that development depended uniquely on individual experience, upon influences wielded by the environment, then the school could accelerate development, telescoping the stages, and "identifying the child with the adult in the shortest possible time [Piaget, 1970b, p. 167]."

Piaget, adhering to an interactionist position in the development/learning controversy, might concur that training makes possible an improvement in performance in almost every type of logical and infralogical operation; he would not, however, agree with the assertion that true operativity has been achieved because of training where no vestige of operativity existed before training (Beilin, 1971b).

> No doubt you will object that some investigators have succeeded in teaching operational structures. But, when I am faced with these facts, I always have three questions which I want to have answered before I am convinced. . . .
>
> Is this learning lasting? What remains two weeks or a month later? . . .
>
> How much generalization is possible? . . .
>
> In the case of each learning experience what was the operational level of the subject before the experience and what more complex structures has this learning succeeded in achieving? [Piaget, 1964, pp. 17-18].

Piaget distinguishes two types of learning which, to him, imply two basically different teaching strategies. Some disciplines--for example French history and spelling--have contents that have been developed or invented by adults. The transmission of these contents "raises no problems other than those related to recognizing the better or worse information techniques [Piaget, 1970b, p.26]." Other branches of learning, however, do not depend upon particular events resulting from many individual decisions, but "upon a process of research and discovery during the course of which the human intelligence affirms its own existence and its properties of universality and autonomy [Piaget, 1970b, p.26]." In this

category he places disciplines such as mathematics and physics. The problem, then, is to decide whether to teach these latter types of disciplines in ways analogous to those of the first type, or to believe, as he does, that a truth is never truly assimilated as a truth unless it has been reconstructed or rediscovered by means of some activity on the part of the learner.

Piaget saw this as the major problem of education in 1935, when he wrote the latter section of Science of Education and the Psychology of the Child. He argues that it remains so today.

> If we desire, in answer to what is becoming an increasingly widely felt need, to form individuals capable of inventive thought and of helping the society of tomorrow to achieve progress, then it is clear that an education which is an active discovery of reality is superior to one that consists merely of providing the young with ready-made wills to will with and ready-made truths to know with. Though, even if one is setting out to train conformist minds that will keep to the already mapped out paths of accepted truths, the question remains one of determining whether the transmission of established truths is more efficiently carried out by using processes of simple repetition or by a more active form of assimilation [Piaget, 1970b, pp. 26-27].

Being submitted to an experience, such as a demonstration, is not sufficient for the child to disengage the structure involved. The child must be active; he must transform things and find the structure of his own actions on the objects. Piaget uses the term "active" in two senses. The first sense is simply acting on material things. The second means doing things in social collaboration, in a group effort.

> This leads to a critical frame of mind, where children must communicate with each other. This is an essential factor in intellectual development. Cooperation is indeed co-operation [Piaget, 1964, p. 4].

Piaget argues that the development of intelligence is dependent upon natural, or spontaneous processes, which may be utilized and accelerated by education at home or school; it is not derived from that education but constitutes the preliminary and necessary condition for the success of any form of instruction (Piaget, 1970b). Teachers provide the instruments which the children use, but the children do the vital work--the discovering. "Children themselves must verify, experimentally in physics, deductively in mathematics. A ready-made truth is only a half-truth [Piaget, 1964, p. 5]." The children, of course, will make mistakes; any process leads to occasional errors, as well as occasional enlightenment. A danger in the school situation, however, is that the child will accommodate to the adult's verbal formulas--"to authority and not to objects as they present themselves" and so " a teacher would do better not to correct a child's schemas, but to provide situations so he will correct himself [Piaget, 1964, p. 4]."

Since knowledge, which is almost synonymous with the processes of logical thinking for Piaget, is derived from action, schools need to appeal to real activity, to spontaneous work based upon personal need and interest.

> This does not mean, as Clarapède so succinctly put it, that children should do anything they want; "it requires above all that they should will what they do; that they should act, not that they should be acted upon. [L'education fonctionelle, p. 252]." Need, the interest that is a resultant of need, "that is the factor that will make a reaction into an authentic act (p. 195)." The law of interest is thus "the sole pivot around which the whole system should turn (p. 197)" [Piaget, 1970b, p. 152].

Piaget agrees with Clarapède and Dewey that compulsory work is "an antipsychological anomaly," and that all fruitful work presupposes interest (Piaget, 1970b, p. 152).

In response to a request to define the relevance of his developmental psychology for education, Piaget (1970a) questioned the aims of education. One may desire to have an educated citizenry, which merely receives and transmits the knowledge of the culture, or one may desire that the members of a society be creators of knowledge who respond constructively to their experience. If one desires the latter, an alternative form of education is required; Piaget opts for and recommends this alternative form. The following is perhaps his most frequently cited pronouncement on education and best summarizes his philosophy of education:

> The principal goal of education is to create men who are capable of doing new things, not simply of repeating what other generations

have done--men who are creative, inventive, and discoverers. The second goal of education is to form minds which can be critical, can verify, and not accept everything they are offered. The great danger today is of slogans, collective opinions, ready-made trends of thought. We have to be able to resist individually, to criticize, to distinguish between what is proven and what is not. So we need pupils who are active, who learn early to find out by themselves, partly by their own spontaneous activity and partly through material we set up for them; who learn early to tell what is verifiable and what is simply the first idea to come to them [Piaget, 1964, p. 5].

Interpreting Piaget for Educational Application

Flavell (1963) held that Piaget probably did not write the best single source for his beliefs on educational method. Aebli (1951) worked with Piaget and his colleagues in Geneva and published a monograph of Piagetian principles for education that bears the psychologist's official sanction. Aebli advances two fundamental tenets: (1) stable and enduring cognitions about the world come about only through active commerce with the world by the subject--Penser, c'est opérer (Aebli, 1951, p. 73); and (2) interaction with peers is of paramount importance in the liberation of the child from egocentrism.

Although there are a handful of sources on Piaget's prescriptions for the classroom since Aebli's work (for example, Piaget, 1964; 1970a; 1970b; 1972), we concur with Flavell in his judgment that the best works on the the relevance of Piaget's findings for educational method were not done by Piaget, but by several of his supporters. Opinions on the application of some specific points are quite divergent, and controversy exists even among the psychologists and educators who studied under Piaget in Geneva, as further discussion will make clear.

Ginsburg and Opper (1969) advance six admittedly general implications of Piaget's views for education, which may be summarized as follows:

1. The educator must make a special effort to understand the unique properties of a child's experience. The thought and language of the young child are qualitatively different from that of the adult. While an educator himself may learn a great deal by reading a book or listening to a lecture, similar experiences may be far less useful for the young child; ideas and sequences of material may not prove as easily assimilable to the child as to the adult. The teacher cannot generalize from his experiences to those of the child.

2. Children, especially the young, learn best from concrete activities.

3. Teachers should be aware of a child's current level of functioning; the classroom must be oriented more toward the individual than the group. There are profound individual differences in almost all areas of cognitive development, and so it is unlikely that any one task or lesson will arouse the interest of or promote learning in all children of the class.

4. The teacher must try to be aware of the child's current level of cognitive functioning, and of the invariant sequence of mental development that Piaget postulates in order to devise curriculum materials that follow this natural course of development.

5. Social interaction should play a significant part in the classroom. "It is hard to see why schools force the child to be quiet, when the results seem to be only an authoritarian situation and extreme boredom. Let us restrict the vow of silence to selected orders of monks and nuns [Ginsburg & Opper, 1969, p. 228]."

6. The "traditional" method of instruction--in which the teacher uses a lesson plan to direct the students through a given sequence of material, attempts to transmit the material to students by means of lectures and other verbal explanations, forces all

> students to cover essentially the same lessons, and employs a textbook as the basic medium for instruction--has grave deficiencies.

In Piaget in the Classroom (Schwebel & Raph, 1973), these six tenets or implications in one form or another are advanced repeatedly by the eleven contributors. Seven of the contributors studied under Piaget in Geneva, and since in the introduction to the book (Schwebel & Raph, 1973, pp. ix-x), he gives his approval to the general style of teaching, it is safe to call such tenets as those that Ginsburg and Opper advance "Piagetian." However, in flavor and argument there is little to distinguish the major points in this book from the points made in many other books calling for drastic changes to make American schools good places to live and learn. Again and again, we are told that the schools are dreary, lifeless, rigid, and boring places, deadly not only for the children but also for the teachers. Teachers are exhorted to focus on the unique aspects of each child's thought, to emphasize the process of thinking rather than the product, and to aim for internal control, rather than external control. Straight rows of desks with quiet, docile children sitting in them are taken to symbolize the dogmatic, authoritarian, rigid attitudes that pervade schools.

These pronouncements are hardly new. For a decade or more nonacademic writers such as John Holt, Paul Goodman, Ivan Illich, Jonathan Kozol, Herbert Kohl, Charles Silberman, and countless others have been arguing for major change. Whether one desires authoritarian, teacher-centered schools, permissive, child-centered schools, or Piagetian, inter-active teacher- and child-centered schools is, essentially, an ethical and emotional consideration. Piaget's philosophy of education is based upon his developmental data, but more important, upon the feeling of confidence--shared by countless others--that children left to their own devices can be left to their own devices in coming to understand these notions. We don't have to try to furnish them [Duckworth, 1973, p. 260].

> If the main thing that we take from Piaget is that before certain ages children are unable to understand certain things--conservation, transitivity, spatial coordinates--what do we do about it? Do we try to teach the children these things? Probably not, because on the one hand Piaget leads us to believe that we probably won't be very successful at it; and on the other hand, if there is one thing we have learned from Piaget it is that children can be left to their own

In short, you don't have to teach children how to think--they all learn for themselves. This is by no means an indication that Piaget thinks teachers are not important. Piaget wrote of his visit, nearly forty years ago, to Susan Isaacs' Malting House school in Cambridge, that Mrs. Isaacs and her collaborators abstained rigorously from all adult intervention on the theory that "it is precisely adult instruction and its clumsy mistakes that prevent children from working [Piaget, 1970b, p. 168]." He went away feeling, however, that some form of systematization applied by the adults would have perhaps not been wholly harmful to the children, noting that:

> those new methods of education that have had the most durable success, and which without doubt constitute the foundation of tomorrow's active school . . . all more or less draw their inspiration from a doctrine of the golden mean, allowing room both for internal structural maturation and also for the influences of experience and of the social and physical environment [Piaget, 1970b, p. 169].

There are two different types of learning which imply different teaching styles. Some information can be taken in simply by rote; Piaget has said he is not against the use of teaching machines. Other knowledge must be constructed through an active dialectic between the learner and what is to be learned. In this type of learning, the teaching method, of necessity, is much less direct.

Birns and Golden cite certain limitations of Piaget's theory, noting that "we ought not ignore motivational and emotional aspects of development [Birns & Golden, 1973, p. 128]," and that the work of Erikson, for one, should not be neglected. Gruber (1973) concurs with Piaget (1930c) that when we link education and child development we are likely to make an error that represents a kind of "magical thinking." We wish that a child will grow up, and he does; therefore, we reason, his growth is a function of our wish. This questionable causal attribution is our main justification for trying to educate children. Thanks to Piaget, we have become increasingly aware that some of the most fundamental ideas, the logical-mathematical processes, are not taught to children by adults.

> Before Piaget's work no one ever dreamed of teaching such elemen-

> tary concepts as the conservation of matter; yet even in those ancient days children universally developed those concepts. Now that Piaget has elucidated this feature of cognitive growth, many educators are prone to incorporate his findings into the professional structure of which they are masters: Teachers teach and children learn; therefore let us teach conservation [Gruber, 1973, p. 74].

But Gruber warns that in the blind rush to accelerate growth, over-expectancy can be a form of oppression. The child may experience the adult's desire to rush him into adult ways of thought as a lack of respect for what he is.

> One day I found my daughter playing with her shadow. She seemed to be trying to get into a room and close the door, leaving the shadow outside. She was having trouble because the light source was a window inside the room. Not wanting to seem silly, she refused to explain her game.
>
> How can we create a world in which a childlike thought will be treated with the respect it deserves? In which the child will know he has that respect? Perhaps this is the right way to read Piaget's work for its educational significance--not as a fixed chronicle of stages in the emergence of a specific inventory of concepts, but as <u>the model of a man who respects children's thinking</u> [Gruber, 1973, pp. 102-103, emphasis added].

Schwebel and Raph (1973) conclude with the point that "there is nothing in the work of Piaget nor in the chapters of this book that suggests there ought to be Piaget schools as there were 'Progressive Schools' [p. 278]." Piaget's work, along with that of others, makes a strong case for schools whose curriculum, particularly for elementary school-aged children, would simply provide opportunities for developing the mind. At the same time, of course, the child would learn as by-products all kinds of facts and skills--some of them highly important. But the emphasis, the <u>raison d'etre</u> of the schools, would be to develop intelligence, not to impart facts and skills.

> There are Piaget schools only in the sense that teachers in them benefit from the knowledge of half a century of research, and that principals value and support teachers whose behavior is guided by that knowledge [Schwebel & Raph, 1973, p. 278].

V
Representative Piagetian Programs

The majority of the efforts to cast Piagetian ideas into a usable educational format have been restricted to preschool and early primary grades. Representative examples of these programs are briefly described below.

Early Childhood Curriculum— A Piaget Program

Celia Stendler Lavatelli, professor of elementary education at the University of Illinois-Urbana, studied with Piaget in Geneva and has developed the "Early Childhood Curriculum (ECC), a Piaget Program."[1] The program's purpose is "to lay a foundation for the emergence of concrete operations [Lavatelli, 1970a, p. 4]." She argues that for Piaget, action by the child upon objects leads to the assimilation of new ideas. ECC is designed as a sequential series of short small-group activities, each requiring interaction with concrete materials.

> Using toys and pennies, for example, a child may on a perceptual level state that there are more toys in a long row than there are pennies to buy these toys when an identical amount of pennies is placed in a pile near the row of toys. Moving the pennies one-to-one beside each toy may cause the child to reconsider; now there is one penny for each toy. After piling up the pennies again he can now realize that for each toy there is still a penny despite the perceptual difference. His thinking has been challenged by operating on real materials in an enjoyable activity [Lavatelli, 1970a, p. 4].

[1]American Science and Engineering, Inc., Boston, Mass., $295.45.

For language development, Lavatelli chose modeling rather than direct instruction, and has related language to the cognitive aspect of each activity in the curriculum. The teacher models a variety of syntactical structures in each activity, such as prepositions, auxiliary verbs, relative clauses, and temporal connectives. The curriculum consists of three sets of materials, a teacher's guide for each set (Lavatelli, 1970b), and Lavatelli's book, Piaget's Theory Applied to an Early Childhood Curriculum (1971). The material kits are classification, number, measurement, space, and seriation. Activities in the classification kit include one-to-one correspondence, identification, matrix puzzles, making "some-all" comparisons, finding common characteristics, intersection of two classes, and combinatorial reasoning. In the number, measurement, and space kit, activities include conservation of number, conservation of volume, conservation and one-to-one correspondence, conservation of direction, conservation of surface area and length, spatial transformations, and spatial visualization. The seriation kit includes activities in seriation by size, seriation of two sets of objects, seriation of length and color, multiple seriation, and transitivity.

ECC was tested in a pilot program at the University of Illinois, and in public school kindergartens in University City, Missouri. "There were significant gains on Binet scores and on Piaget type tests [Lavatelli, 1970a, p. 4]."

The Cognitively Oriented Curriculum: A Framework for Preschool Teachers

David Weikart and his associates at Ypsilanti, Michigan (High/Scope Educational

Research Foundation) categorize preschool programs under one of four general classes: Programmed, Child Centered, Custodial, or Open Framework. The Programmed model is one in which the teacher initiates activities, and the children respond to them. Several major innovative programs included in the current wave of compensatory preschool projects have programmed curricula. These curricula tend to be aimed toward clearly designed educational goals, such as reading, language, and math skills. Although many program developers in this model show little respect for traditional education at any level, according to Weikart, the goal of many programs is to equip the youngster with the skills necessary to manage the demands of such education. Englemann-Bereiter's DISTAR program is placed in this category, along with Glaser and Resnick's Primary Education.

In the Child-Centered category, Weikart places Bank Street College programs, Ron Henderson's Tucson Early Education Model, Glen Nimnicht's Responsive Program, Robert Spaulding's Durham Education Improvement Project, and the Montessori programs. In these, the child initiates activities and the teacher responds. Curricula tend to focus on the development of the "whole child," with emphasis on social and emotional growth.

A third program category, the Custodial, is characterized by Weikart as being one in which the teacher responds and the child responds; at best, these programs protect the child from physical harm, and may be some improvement over poor social conditions. "With the knowledge and resources available today, there is little excuse for maintaining custodial centers where teachers and children respond to nothing but physical needs, since nothing is initiated [Weikart, 1971, p. 27]."

The fourth category Weikart delineates is the Open Framework, in which the teacher initiates activities, and the child initiates activities. Included in this framework are programs such as Susan Gray's Demonstration and Research Center for Early Education, Merle Karnes' Ameliorative Preschool, Herbert Sprigle's Learning to Learn, and Weikart's Cognitively Oriented Curriculum. These programs subscribe to specific theoretical goals, but depend upon the teacher to create the exact curriculum in which the child participates. Curricula are focused upon underlying processes of thinking or cognition, and emphasis is on learning through direct experience and action by the child. Open Framework schools omit training in specific areas such as reading or arithmetic, treating these skills as inevitable outcomes of emergent cognitive ability. The responsibility for developing the child's capacity to reason and to recognize the relationship of his own actions to what is happening in his environment is accepted, but program developers and teachers tend to be skeptical of claims that solutions to problems or academic skills can be taught directly to preschoolers.

Open Framework curricula are usually based upon a theory of child development, according to Weikart, and Piaget's is the most popular. The program is oriented toward organizing and utilizing the people involved rather than any special equipment. They demand that the teacher create a transaction between the child and the environment to develop abilities; concepts are to be learned through activity, not by repetition of what the child has been told. The major difference for Weikart between a cognitively oriented curriculum based upon Piaget and the traditional, child-centered program seems to be the foundation in developmental theory for the former, and the allegedly less-rigorous theoretical foundations of the latter. "If theory is involved in one of these programs (Child Centered), it is usually a theory of emotional development. The actual curriculum developed by the teacher comes mainly from her own intuitive understanding of child development on the one hand and her observation of the needs of her children on the other [Weikart, 1971, pp. 27]."

The Ypsilanti Preschool Curriculum Demonstration Project was established in 1967 (Weikart, 1973) in an effort to determine which preschool framework--a Programmed model, an Open Framework, or the traditional child-centered classroom--makes the greatest difference for young children. Three programs were selected for the test: Weikart's Cognitively Oriented Curriculum as the Open Framework model; a Language Training model as the Programmed framework; and a Unit-based curriculum. Weikart's curriculum was based upon the principles of sociodramatic play as defined by Sara Smilansky, principles derived from Piaget's theory of intellectual development, and the observations of teachers. The Programmed model was developed by Bereiter and Engelmann (1966) at the University of Illinois. It is a task-oriented curriculum employing techniques from foreign language training, and includes the direct teaching of language, arithmetic, and reading. The Unit-based curriculum (a Child-Centered model), emphasized social-emotional goals, and used teaching methods of the traditional nursery school.

Children in the study were functionally-retarded three- and four-year-olds from disadvantaged families living in the Ypsilanti school district. They were stratified according

to sex and race and randomly assigned to one of three treatment groups. Two teachers were assigned to each model, after expressing preferences. They taught classes for half a day, and conducted a teaching session in the home of each of their children for 90 minutes every other week. The home teaching was executed in the same curriculum style as the classroom program in which the child was involved. All three programs had clearly defined weekly goals, and curriculum implementation followed carefully planned daily programs designed independently by the three teaching teams to achieve the goals of their individual curriculum. "The provision for teacher involvement was a crucial aspect of the overall project [Weikart, 1973, p. 13]."

Much to Weikart's surprise, all three programs did unusually well on all criteria.

> More importantly, the finding indicated no significant differences among the three curricula on almost all of the many measures employed in the program assessment: several intelligence tests (average Stanford-Binet IQ gains in the three programs by three-year-olds of 27.5, 28.0, and 30.2 points in the first year); classroom observations; observations in free play settings; ratings of children by teachers and independent examiners; and evaluations by outside critics. These data were essentially replicated at the end of the project's second and third year [Weikart, 1973, pp. 13-14].

Weikart's basic conclusion from the experiments, then, is that the operational conditions of an experimental project are "far more potent in influencing the outcome than the particular curriculum employed [1973, p. 16]." The curriculum is more important for the demands it places upon the staff in operational terms than for what it gives the child in content terms.

Weikart (1973) presents a brief review of the Cognitively Oriented Curriculum, focusing on classification exercises specifically derived from Piagetian theory (Inhelder & Piaget, 1964). Weikart and his colleagues wrote a sequence of classification goals, or exercises, for children. Classification skill is seen as a basic prerequisite for reading and math skills. The purpose of the High/Scope curriculum is not to teach children how to classify, nor to speed up the acquisition of classificatory ability, but to develop universally innate potentialities. Weikart's exercises follow:

1. Identifying an object that does not belong to a set;

2. Identifying an object that is the same (identical);

3. Finding an object that is the same in some way (alike, similar);

4. Finding an object that is not the same (different);

5. Saying how objects are identical, similar, different;

6. Grouping two or more objects, the child using his own criteria;

7. Sorting all the objects in a group and accounting for all;

8. Sorting all the objects in a group into two sets (dichotomizing);

9. Sorting and re-sorting objects using different criteria; re-sorting when new objects are added to the group;

10. Identifying a set and one of its parts or subsets and comparing the part to the whole; correctly recognizing that the whole is greater than the part;

11. Sorting objects into hierarchical systems of increasingly inclusive classes; recognizing and identifying increasingly inclusive classes and comparing sub-classes to the whole [Weikart, 1973, pp. 8-12].

A summary of procedures for classroom use of these classification exercises follows:

1. Teachers set out or control materials in interest centers that are conducive to sorting, arranging, comparing, combining;

2. Child chooses interest centers, materials, and the result he desires;

3. Teacher observes child and on the basis of what the child is doing, extends the child's activity either through questions or suggestions of materials; the teacher explores several exercises but encourages the child to use one he is capable of to complete his project;

4. Teachers evaluate the day, con-

> sidering what each child has done; additional materials are set out as indicated by children's interests and the potential for the exercise of cognitive abilities [Weikart, 1973, pp. 14-15].

This method bears a notable resemblance to that developed by Kamii and DeVries (in press) and to the program in the Early Childhood Study Center, University of Wisconsin-Madison (Bingham-Newman, et. al., 1974).

Piaget for Early Education

Constance Kamii at the University of Illinois, Chicago Circle Campus, is unquestionably the most active and productive Piagetian classroom "designer." Her work in most respects represents a notable fusion of nondiluted Piagetian theory and operational pragmatics. Her initial efforts in applying Piagetian developmental psychology to teaching began while working with David P. Weikart for the Ypsilanti, Michigan, Early Education Program in the mid-1960's. Today, she describes these initial efforts as being misguided, and erroneously derived from Piagetian theory. Early objectives were to teach Piagetian tasks and to move preschool children to the stage of concrete operations. But Piaget's tasks were devised to get answers to certain theoretical questions, and the stages found for each of these tasks are not necessarily the stages children go through naturally. As an example, children do not learn to seriate little sticks or dolls in order to become capable of concrete operations: "learning to seriate sticks or dolls is not more than learning to seriate sticks or dolls. Teaching this is ridiculous if our real aim is logical thinking [Kamii & DeVries, in press, p.38]." Sinclair (1971) has argued that to try to teach Piagetian tasks is like trying to fertilize an entire field by fertilizing a few soil samples. A very specific skill may be shown to improve, but the evidence is less compelling that overall operativity has been enhanced to any great degree.

Kamii and Derman (1971) questioned some six-year-old children at the University of Illinois who had been taught by S. Engelmann to answer questions that children cannot usually answer until they are about eleven years of age (e.g., the concept of specific gravity or why certain objects sink and others float in water). Engelmann, according to the authors, held that Piagetian stages are primarily a matter of teaching and that the concept of specific gravity could be taught to six-year-olds. He taught this to kindergarteners, and allowed Kamii and Derman to administer the posttests.

> What we saw was that underneath the overlay of correct answers the children have learned, their thinking clearly remained preoperational. For example, they predicted that a big candle would sink but that a tiny one would float, or that one cake of soap would sink and an identical cake of soap would float [Kamii, 1973, pp. 225-226].

To an orthodox Piagetian, these findings suggest that no stage can be skipped and that development cannot be accelerated in a few weeks from a six-year-old level to an eleven-year-old level, i.e., "We can get surface conformity to adult reasoning, but all of us know that what we learn in this manner is forgotten as soon as the final exam is over [Kamii, 1973, p. 226]."

In Piaget for Early Education, Kamii and DeVries (in press) begin with a discussion of the theoretical foundations of their Piagetian curriculum for young children. Piaget, it is argued, is an "interactionist-relativist" who believes in the construction of knowledge by the interaction of sensory experience and reason. Empiricist views lead to an emphasis on what is external to the child; whereas, Piaget's interactionist view leads to an emphasis on the internal.

"Many people read into Piaget's theory their empiricist biases and distort its meaning without being aware that they are doing this [Kamii & DeVries, in press, p. 3]. Weikart and Lavatelli are included among the "false interpretors" accused of developing curricula that is very un-Piagetian. Weikart is charged with numerous distortions of Piagetian theory, including confusion between the development of operativity, and the development of representation. Kamii and DeVries see Weikart as being preoccupied with teaching symbols and words, rather than encouraging reflection to develop operativity. Lavatelli (1971) demonstrates a theoretical understanding of Piaget, according to Kamii and DeVries, but in her Teacher's Guide (Lavatelli, 1970b), she outlines a completely empiricist curriculum and pedagogy. Lavatelli is also charged with emphasizing language over thinking: "The teaching of words is not the same thing as developing children's power of reasoning [Kamii & DeVries, in press, p. 5]."

Kamii and DeVries derive seven principles of teaching in the socioemotional and cognitive realms, based on Piaget's theory:

1. Encourage the child to be independent and curious, to use initiative

in pursuing curiosities, to have confidence in his ability to figure things out for himself, to speak his mind with conviction, and to cope constructively with fears and anxieties and not be easily discouraged.

2. Encourage the child to interact with other children and to resolve conflicts among themselves.

3. Practice cooperation and equality with the child insofar as this is possible.

4. Teach in the context of the child's play.

5. Encourage and accept the child's "wrong" answers.

6. Teach according to the kinds of knowledge.

7. Teach to content as well as to process.

Quite pointedly in opposition to Lavatelli, Kamii and DeVries note that they do not aim to teach Piagetian tasks, nor do they aim to move children to the stage of concrete operations.

The authors separate objectives into long-term and short-term ones. Long-term objectives aim at the development of the entire personality, with particular emphasis on intellectual and moral autonomy. Short-term objectives include those which are socio-emotional which the authors neglect to rigorously define, using only the terms "alertness" and "curiosity"; they argue, however, that their definitions of these words are much different from Engelmann who, they say, believes that a curious child is a child interested "in what the teacher wanted him to be curious about [Kamii & DeVries, in press, p. 43]." Besides short-term socioemotional objectives, the authors posit short-term cognitive objectives, which are for the child "to come up with interesting ideas, problems, and questions; and to put things into relationships and notice similarities and differences."

The authors believe their Piaget-derived curriculum differs from the traditional child-development program because the latter "is based mostly on empiricist assumptions about how the child learns," its methods are "largely intuitive," and the child-development curriculum does not reflect "an adequate appreciation for the nature of preoperational intelligence [Kamii & DeVries, in press, p.51]." What is missing from the traditional child-development curriculum, according to the authors, is a theoretical rationale, the absence of which often leaves the child-development teacher making decisions according to what <u>feels</u> right.

In general, Kamii and DeVries derive from Piagetian theory the moral that "it is fruitless to try specifically to organize content for children [Kamii and DeVries, in press, p. 58]." Children will invariably assimilate whatever we tell or show them in ways that are different from adult notions. From a long-range developmental point of view, then, children who are constantly using their initiative to figure out wonderful things to do are more likely "to learn more deeply and go on creating new ideas than those who dutifully sat in a group in front of the teacher, waiting for her to ask a question [Kamii & DeVries, in press, p. 59]." The teacher's role is

> to create an environment and an atmosphere conducive to learning; to provide materials, suggest activities, and assess what is going on inside the child's head from moment to moment; to respond to children in terms of the kind of knowledge involved; and to help the child extend his ideas [Kamii & DeVries, in press, pp. 64-65].

Teacher training in this type of program is more important to Kamii and DeVries than a curriculum in the sense of specific things to do. The theory does not imply a specific curriculum that can be neatly packaged (as Lavatelli has done, to Kamii's apparent dismay), and given "as a cookbook to teachers [Kamii & DeVries, in press, p. 72]." A Piagetian teacher is not a technician who puts children through preprogrammed procedures, but an autonomous professional who makes professional judgments.

The curriculum or approach to early childhood education that the authors describe, has not yet been evaluated for effectiveness for two reasons: (1) it is still undergoing development; and, (2) summative evaluation of the long-range outcome of the curriculum is not possible "as long as children have to go to repressive, traditional schools from ages six to sixteen (or beyond) [Kamii & DeVries, in press, p. 74]." Most elementary and secondary schools emphasize obedience, conformity, verbalism and memorization--exactly what the authors are against. As a result, they have little hope for what preschool education can accomplish.

Formative evaluation, on the other hand, has been thorough. The procedure has been to develop activities, test them in the class-

room, and modify them according to the findings.

Thinking Goes to School

> Whenever anyone can succeed in transforming their first steps in reading, or arithmetic, or spelling into a game, you will see children become passionately absorbed in those occupations, which are ordinarily presented as dreary chores [Piaget, 1970b, p. 155].

This statement may almost be taken as a credo for the work of Hans G. Furth and Harry Wachs in the Tyler Thinking School, Charleston, West Virginia (Furth & Wachs, 1974). Seeing each child as an individual, in Thinking Goes to School the authors described a philosophy and a program for four- to ten-year-old children which could be adjusted to fit all children. The 179 games and play sequences they designed were to develop the child's thinking ability. It is argued that the activities or games should help the child deal with specific academic subjects; that they can be played at home or at school; and that they require no elaborate or expensive equipment.

Furth and Wachs helped create a learning environment in which there was "freedom within structure." The children, emphatically, did not do anything they felt like doing or nothing at all. The environment developed was midway between schools in which children are left to do as they want, and the highly structured schools in which every response of the child is programmed. Long-range objectives were fivefold:

1. To develop creative, independent thinking;
2. To develop within the child a positive self-image;
3. To develop attitudes of social cooperation and moral responsibility;
4. To develop a knowledge and appreciation of persons, things, and events in the environment;
5. To develop competence in the basic skill areas of reading, writing, and arithmetic [Furth & Wachs, 1974, p. 41].

The Charleston project never became a fully developed "School for Thinking," if only for the obvious reason that it lasted only two academic years, September 1970, to June 1972. The school was discontinued by the administration. The factors that limited the school's impact and made continuation and expansion of the project in the Charleston school district nonfeasible were the lack of strong, cooperative support; the lack of desirable resource people; and the push for premature academic performance. There was "constant pressure to show short-term results on standard reading tests, and the constant need to justify the program not on its own terms, but in terms of the traditional philosophy and of immediate results [Furth & Wachs, 1974, p. 270]." This, of course, is the common complaint of proponents of alternatives to traditional education who value process over product, independence over dependence: traditional evaluation procedures simply do not measure what alternative schools have been attempting to achieve.

The Piagetian Preschool Educational Program (PPEP)

A preschool curriculum embodying the major principles of Piagetian theory and normative research with three- to five-year-old children has been designed at the University of Wisconsin Early Childhood Study Center. Similar in general approach to Kamii's endeavors, this program has been the focus of a comprehensive three-year field evaluation (Bingham-Newman, et al., 1974). The general aim has been an examination of a Piaget-based preschool program as a potential facilitator in the process of developmental change.

In the PPEP curriculum, children should independently discover certain aspects of the world. Thus the research aim was not the specific teaching of logical operations concepts per se. Several successful training studies (viewed in terms of specific task transfer effects) have utilized the techniques of cue discrimination, correct language comprehension and usage, direct corrective feedback, and in some cases provided explicit reinforcers for correct answers to criterial questions. In the Wisconsin study, however, children were encouraged to actively manipulate objects, were asked probing questions, and were encouraged to openly interact with their peers, but correct answers were not taught if they had not already developed in the mind of the child. The researchers felt that it is good for children to find out about the world for themselves, and that the correct answers are not as important as the underlying thinking processes.

The following principles furnished the framework for the Piagetian Preschool Education Program (PPEP):

1. More than the mere accumulation of facts, intelligence is the incorporation of the given data of experiences into an organized framework.

It involves the individual's ability to organize and adapt through the reciprocal processes of assimilation and accommodation to various aspects of the environment.

2. Intelligence is developed through interaction between the environment and the organism. Timing and quality in an environment are important factors for an evolving intellect.

3. Growth of intelligence enhances functioning in all areas of psychological development, including affective, cognitive, and psychomotor development.

4. Learning is an active process, subordinate to development, which involves manipulative and exploratory interaction with the environment in the search for alternative actions and properties applicable to objects and events. This involves both mental and physical activity.

5. Each stage in the development of intelligence is characterized by the presence or absence of specific cognitive operations--children think about the world very differently than adults. They make different interpretations and draw different conclusions from given events than adults do.

6. There is an invariant sequence of development through the major periods of cognitive growth: sensorimotor, preoperational, concrete operational and formal operations and the within stage sub-sequences associated with the various concept domains. Each individual moves through the sequence at his own pace.

7. Language helps to focus on concepts and to retrieve them. It does not <u>in itself</u> build concepts.

8. Intellectual growth is fostered by social interaction with peers and adults as well as by interaction with the physical environment.

9. Autonomy with cooperation, rather than simple obedience to authority, contributes to the child's intellectual and moral development.

In defining goals for the Piagetian Preschool Education Program (PPEP) emphasis was placed on the development of intelligence. However, as implied in principle three, it is equally important to emphasize the rapprochement between the cognitive, affective, and perceptual-motor domains of behavior. Cognitive functioning in a particular situation is necessarily subject to one's emotional and physical condition. Likewise, one's ability to deal with emotional and physical aspects of a situation depends on one's intellectual capabilities. The same is true throughout the course of development--the influences are reciprocal. Therefore, emotional and physical development are major concerns in the program and the PPEP goals apply to all three domains.

The long-range goal for teachers and children in the PPEP was directed toward helping to form a particular kind of individual. Desirable characteristics of children and adults are the same, though the expression of those characteristics will differ. The program endeavors to help form:

1. An individual who relates intellectually, flexibly, and creatively to his environment.

2. An individual who looks for alternative ways of solving problems.

3. An individual who is able to initiate his own learning experiences by exploring, experimenting, and asking questions.

4. An individual who has confidence in himself.

5. An individual who is a critical thinker who does not accept the first answer given as the only answer or the right answer without checking it out (see Piaget, 1964, p. 5).

6. An individual who interacts empathetically and appropriately with peers and other age groups.

To help the child relate to his environment the PPEP focused on four content areas: Logico-mathematical knowledge of the physical environment, and knowledge of the social environment (Bingham-Newman, 1974, pp. 53-56).

The daily two-and-a-half hour schedule for the PPEP included in a variable sequence: arrival and free play (60 minutes) clean up (15 minutes), snack time (15 minutes), large

group meeting (20 minutes), small group activities (15 minutes), and concluding outside play (25-30 minutes). The small group activities emphasized specific logical concepts such as classification, seriation, numbers, and space-time in addition to measurement and representation skills. Approximately 200 small group activity plans were devised over the three-year program period. Routine formative evaluation was conducted throughout the 28-week school year and a teacher training program was an integral component of this curriculum design effort .

Summative evaluation was conducted at annual intervals and comparisons were made of four groups of 20 children (PPEP program participants and a group of children attending a comparable conventional preschool nursery program) in two phases (1971 to 1973, and 1972 to 1974). An overall total of 48 children constituted the longitudinal comparison group (30 PPEP subjects and 18 controls). Assessment measures included the Peabody Picture Vocabulary Test, the Raven Coloured Progressive Matrices Test, and Piagetian tasks of seriation, classification (dichotomous sorting and cross class matrices), double series matrices, transitive inference, measurement skills, and conservation of number, length, and quantity.

While the results of the initial year's comparisons were somewhat disappointing (Burke-Merkle, et al., 1973), later assessments were generally encouraging and significant gains were shown by both groups of children on the majority of the summative measures. Few of the PPEP versus control group comparisons were significant. Beyond the test results themselves, there was considerable evidence that the Piagetian program was functionally effective; senior and student teacher evaluations, the children's level of responsiveness, enthusiasm, and interest, and the consistent support of the cooperating parents, all were distinctly positive (Bingham-Newman, et al., 1974).

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VI
Overview of the Representative Piagetian Programs

In summary we may categorize these program design endeavors in terms of two general criteria: (1) the degree of adherence of the program to orthodox Piagetian theory, and (2) the postulated locus of action-instruction initiation. As Figure 1 indicates, each of these criteria may be characterized as a continuum.

It is proposed that the location of a program on one continuum effectively constrains its approximate position on the counterpart category scheme. Thus the programs which are closest to pure Piagetian theory also are the most extreme in terms of child-centered activity. In addition, as you move from right to left in Figure 1, much less concern is expressed for short-term, task specific evaluation and the utilization of coordinate behavioral objectives for curriculum design purposes. As mentioned previously, Kamii and DeVries (in press) eschew short-term evaluation altogether and are pessimistic about the potential efficacy of long-range evaluation in the context of most of today's traditional school systems. The disparity between the polar comparisons, i.e., Kamii and DeVries' program contrasted with certain S-R inspired training programs such as DISTAR, is notable indeed. In terms of the present discussion, the only fundamental similarity appears to be that the programs are coincidently investigating the origins and modifiability of the same class of behaviors, e.g., conservation concepts. Finally, as you move from right to left in Figure 1, you shift from a mechanistic to an organismic model of human cognitive functioning (cf. Overton & Reese, 1973; Reese & Overton, 1970).

As Denis-Prinzhorn, Kamii, & Mounoud (1972) point out it is also possible to characterize putative Piagetian educational programs in terms of (1) separate and distinct Piagetian task settings as foci for instruction (the S-R training programs and possibly Lavatelli, 1970a), (2) school settings where a certain part of the day is reserved to teach how to solve Piagetian tasks (Lavatelli, 1970a; Weikart, et al., 1971), and (3) attempts to derive the entire curriculum broadly from Piaget's particularistic views of "knowing" and "learning" as distinguished from both the specific stages and associated tasks (the later Kamii programs; Furth & Wachs, 1974; and the Wisconsin PPEP).

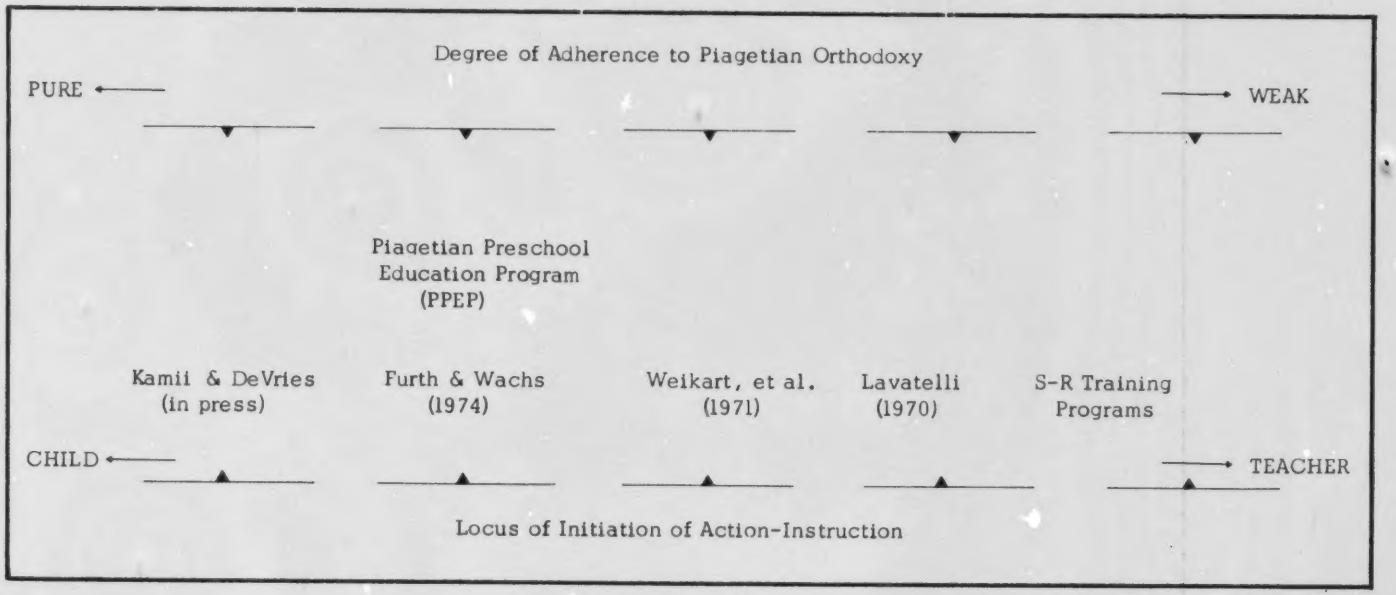

Figure 1. A Continuum of Representative Piagetian Inspired Educational Programs

VII
Current Criticisms of Piagetian Theory and Associated Educational Recommendations

A number of recent writers have openly been skeptical about Piagetian educational recommendations or have at least urged caution in the uncritical acceptance of them (e.g., Beillin, 1971b; Kohnstamm, 1967; and Sullivan, 1967, 1969). As Sullivan has noted:

> The Piagetian contribution to the structure and sequencing of subject matter is more apparent than real. This is clearly not the fault of Piaget, but rather of his educational followers. Uncritical extrapolation of Piaget's observations and his methodological considerations (e.g., logico-mathematical model) is, in the opinion of the present author, harmful to the advancement of educational knowledge. The use of Piaget's stages as indicators of "learning readiness" seems most premature and needs more careful consideration on both the research and theoretical levels [Sullivan, 1969, p.33].

We may briefly summarize the more cogent of these criticisms. Initially, it is readily apparent that the equilibrium dynamics have not yet been translated into a realistic operational format. One could well ask, for example, how you really measure operativity. Little agreement exists between Piagetians and Neo-Piagetians on the conceptual and operational definitions of operativity (Beilin, 1971b). In general, the related cognitive conflict model said to underlie logical concept acquisition has not been substantiated. Cognitive conflict approaches to instructional programming have not proven to be particularly efficacious although the match-mismatch hypothesis (Hunt, 1961) remains intuitively appealing.

Piaget's outspoken criticism of verbal instructional procedures is paradoxically limiting for theoretical and practical reasons. This is apparent for the following reasons (Beilin, 1971b): (1) the special relationship between language and logical thought processes remains unknown or conjactural, (2) "actions" as defined by Piaget also occur in linguistic contexts, (3) language is an activity which itself embodies operational properties (cf. Riegel, 1970), and (4) language interchanges (e.g., corrective feedback) appear to be present to varying degrees in most of the successful training investigations (cf. Brainerd, 1974). Considering the heavy reliance upon language in the méthode clinique the reservations of Piaget are most perplexing to the non-Genevan investigator.

The most controversial tenet of the Piagetian doctrine is, of course, the disavowal of specific instructional influences upon logical concept acquisition. Yet, the role of structured experiences upon logico-mathematical or infralogical concepts surely remains to be elucidated. The question of how much prior or concurrent knowledge that can only be acquired via rote or didactic methods is essential to the acquisition of logical concepts (Beilin, 1971b). This essentially involves the interrelationship of the three knowledge forms cited above (physical, social, and logico-mathematical). As Beilin (1971b) has pointed out Piaget has amply demonstrated how complex the growth of logico-mathematical concepts can be. Piaget consistently maintains that these concept acquisitions evolve from a series of active constructions--but no complimentary educational technology has been designed and subsequently evaluated. As the reader can surmise, this paradoxical situation follows directly from the Genevan views concerning the origins of logico-mathematical thought--rather small consolation to the classroom teacher responsible for the teaching of mathematical skills and associated understandings.

It is commonly asserted that a Piagetian orientation inevitably implies use of one-to-one or individualized instruction procedures. However, it is questionable if Piaget ever directly recommended the intact extrapolation of his procedures, e.g., the méthode clinique, to classroom settings (Piaget, 1970b). In reality, the general Piagetian orientation stresses both performance uniformity across children in the same developmental stage (and low intraindividual variability via the within-stage correspondence postulate) and inherent performance variability because each child's current potential is a product of his unique past experiences and the present situational determinants. Variability in the Piagetian normative findings is usually handled in post hoc fashion by the horizontal décalage construct. Acknowledging the dangers of oversimplification, the Genevans appear to use cases of behavioral uniformity (of both inter- and intraindividual types) as evidence for structural determination and to relegate cases of demonstrated variability to more trivial performance factors. The systematic accommodation of individual difference factors into the Piagetian stage approach has yet to be realized.

Surely it is hard to imagine the introduction of one-to-one instruction in today's overcrowded, understaffed, and heterogeneously grouped public schools. Still, there is the general feeling that most successful teachers accomplish a certain amount of individualized instruction despite these handicaps. Of course one would expect that these problems would be much less acute for specialized programs with optimal staff-pupil ratios.

In the final analysis the success or failure of any educational program depends upon the ability of the classroom teacher. We must recognize that an honest and consistent acceptance and implementation of a Piagetian-inspired curriculum will be exceptionally demanding upon the classroom teacher at all grade levels. When we accept a view of the child as an ever-active, self-constructive organism we also require, in complementary dialectical fashion, an active ever-alert teacher who is willing to forego traditional group-based instruction. In brief, there is the definite possibility of cognitive and affective "overload" for the Piagetian teacher who cannot, by definition, operate within a highly structured, preset series of lesson plans or instructional guides.

VIII
The Modifiability of Piagetian Logical Structures

Since a considerable number of recent reviews of the Piagetian training research literature are available (e.g., Beilin, 1971b; Brainerd, 1974; Brainerd & Allen, 1971; Glaser & Resnick, 1972; Hooper, Goldman, Storck, & Burke, 1971; Klausmeier & Hooper, 1974; and Wohlwill, 1970, 1973), this discussion will be brief. While it cannot be said that controversy is nonexistent (cf. Brainerd, 1974, contrasted with Strauss, 1972), certain generalizations are evident concerning the efficacy of instructional programs designed to teach Piagetian concepts.

Initially we must distinguish between the two forms of concept novelty associated with Piagetian theory (Beilin, 1971a). At the most general level Piaget is concerned with the developmental processes and operations which make concept acquisition possible. Knowledge attainment is seen as an active constructive process which is subject to the same fundamental biological principles as all adaptive behavior. The overriding developmental process is the equilibration dynamic which subsumes the functional invariants of assimilation (the incorporative mechanism which modifies incoming stimulation in terms of the individual's current structural status) and accommodation (the outgoing aspect which governs subsequent integration and differentiation of cognitive structure). The Genevans appear to accept content specific concept units as noninteresting givens upon which the processes of logical thought operate. The equilibration dynamics are seen as primarily applicable to the systems of classes and relations which subsume class and relations concepts per se.

The generalizations concerning Piagetian concept instructional research investigations are rather straightforward. If one wishes to assume the time and effort, specific Piagetian logical concepts are generally modifiable. That is, if you are judicious in your selection of concept domains and subject populations, specific training transfer effects are a likely result. In general, the older the child and the easier the concept acquisition the greater the likelihood of significant treatment effects. While the issues are extremely complex, the efficacy of any instructional investigation remains a product of the interactive factors of (1) the developmental status of the subject population, (2) the degree of normative concept difficulty or complexity, and (3) the type of training procedure employed. In view of Brainerd's (1974) recent research employing a direct corrective feedback approach, the primary determinant is the position the focal concept occupies in the relevant developmental hierarchy. In general, specific transfer is readily demonstrable (for the appropriate aged subjects) while far transfer and durable acquisition patterns remain somewhat questionable.

What is obviously necessary is a comprehensive assessment-intervention investigation which utilizes a wide range of Piagetian logical operations over a considerable time span. Training upon a specific concept area for children of demonstrated structural status (via separate cognitive assessments) may be compared to the logical structural counterparts who have been instructed in a complimentary concept domain. The specific and far transfer concept assessments may then be continued for a considerable time interval. Thus the pertinent questions of specific transfer, far transfer, and developmental stability may be answered.

IX
Conclusions—Valid Principles from Piagetian Theory

In view of these substantial reservations and caveats, one may well ask what the major advantages to accepting a Piagetian educational philosophy are. Initially, the Piagetian perspective demands an awareness of process/product distinctions. One must possess a genuine feeling for and understanding of the processes (rather than the products) of idiosyncratic child thought. As Denis-Prinzhorn, et al., have stated:

> When the researcher's interest is in the teachability of a task, his attention necessarily becomes focused on the correctness of the answers children give on the posttest....
>
> The tasks Piaget and his collaborators have designed during the past 30 years or so have been intended as means of determining the type of structure which characterizes each level of development. For Piaget, the thing is the process of thinking, and the structure that the process has attained. The answer the child gives is of interest to Piaget only insofar as it tells us something about the underlying process.
>
> (and further)
>
> The role of a Piagetian teacher is very different from the traditional one. She is no longer the authority who "teaches" but, rather, a stimulator of questions and a guide to help children figure out their own answers....
>
> The application of Piaget's theory to education is very difficult because it consists neither of materials nor of techniques to be prescribed, but, rather, of ways of understanding how children think [1972, pp. 68 and 71].

Perhaps the most succinct way of capturing the essence of this process approach to education is to state, "the child because of his egocentric view of the world always answers correctly the question he asks himself [S. Papert as quoted in Kamii & Peper, 1969]."

A second valuable contribution of Piagetian theory concerns the crucial role assumed by play activities. Play and the conceptually related imitation activities are the principal means which give rise to symbolic functioning. Thus, play activities assume theoretical and practical consequence; major emphasis upon play was found in the programs of Kamii and DeVries (in press), Furth and Wachs (1974), and Bingham-Newman, et al., (1974).

Closely related to the previous point, social interaction and associated peer group processes assume significant importance in Piagetian theory. It is through social interaction that cognitive progress (e.g., decentration, nonegocentric reasoning) becomes possible. This is of rather obvious importance for the teacher of young children. The teacher may facilitate peer relationships but she (or he) can never assume the role of an appropriate partner in the child's peer-peer dyad (Kamii & DeVries, in press).

By far the most salient principle which emanates from Piagetian theory is the essential stipulation of self-initiated active involvement with the physical and social objects provided in the classroom. This principle provides the fundamental continuity between Piaget's views and the numerous open classroom and self-discovery learning approaches to educational innovation (Furth & Wachs,

1974; Schwebel & Raph, 1973). Piaget provides the open classroom approaches with a systematic theoretical foundation and guiding rationale. Reciprocally, it is only via an open classroom framework that a genuine version (i.e., acceptable to Piaget) of Piagetian theory in educational application can be operationally implemented. As Furth and Wachs conclude:

> Consequently one will find the leading themes of the great educational thinkers of the past and the present incorporated in Piaget's theory. The absorbing mind of a Montessori, the organic reading of an Aston-Warner, the experiential-pragmatic orientation of a Dewey, the freedom of inquiry of a Rogers, the openness of the British infant school, the feeling and awareness of Gestalt therapy, the bring-to-consciousness of a Freire, and the deschooling of an Illich, as well as the programmed learning and the behavioral modifications of association theory--these and other ideas represent so many different aspects of the developing child, forcibly enunciated by involved persons. <u>These themes need an all encompassing theory such as Piaget's to fall into place and to become available as a viable theory of development and learning for all schooling</u> [1974, p. 281].

A final issue concerns the provision for long-range summative evaluation. In actuality the empirical assessment of the relationship of the abstract conceptual systems (logical hierarchies) of mathematics, for example, and the child's cognitive structure is still in progress (Hooper & Klausmeier, 1973). Comprehensive summative evaluation of Piagetian educational programs can only be accomplished by means of long-range longitudinal assessment. A minimum prerequisite for a viable assessment of any Piagetian educational program is an alternative to today's traditional public schools (in which the conventional programs are in many ways often completely antithetical to all that Piaget stands for). Obviously, what is needed is an open classroom system, embodying the major features outlined above, for the preschool, elementary, and the secondary school years. Then a fair evaluation of Piagetian alternative educational programs would be possible.

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